

METHOD AND SYSTEM FOR HIGH
RESOLUTION, ULTRA FAST 3-D IMAGING

ABSTRACT OF THE DISCLOSURE

5 A high-speed three-dimensional imaging system includes a single lens
camera subsystem with an active imaging element and CCD element, and a correlation
processing subsystem. The active imaging element can be a rotating aperture which
allows adjustable non-equilateral spacing between defocused images to achieve greater
depth of field and higher sub-pixel displacement accuracy. A speckle pattern is
projected onto an object and images of the resulting pattern are acquired from multiple
10 angles. The images are locally cross-correlated using a sparse array image correlation
technique and the surface is resolved by using relative camera position information to
calculate the three-dimensional coordinates of each locally correlated region. Increased
resolution and accuracy are provided by recursively correlating the images down to the
level of individual points of light and using the Gaussian nature of the projected speckle
15 pattern to determine subpixel displacement between images. Processing is done at very
high-speeds by compressing the images before they are correlated. Correlation errors
are eliminated during processing by a technique based on the multiplication of
correlation table elements from one or more adjacent regions.

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